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ILLINOIS STATE ENTOMOLOGIST
URBANA, ILLINOIS

The Chinch-bug in Illinois in 1914

PREPARATIONS FOR THE SUMMER CAMPAIGN

The present is the fifth year of the continuance of a destructive outbreak of the chinch-bug in southwestern and western Illinois, resulting in a very heavy loss to the agriculture of the state; and the prospect at the present writing is that the following twenty-two counties will be more or less heavily infested this year:—

Bond, Brown, Cass, Christian, Clinton, Greene, Jersey, Macon, Macoupin, Madison, Marion, Menard, Monroe, Montgomery, Morgan, Pike, Randolph, Sangamon, Scott, Shelby, St. Clair, and Washington.

The bugs are now in their winter quarters, where a very small percentage of them have perished during the winter. From their present places of shelter they will begin to scatter over the country on the wing during this month of April, settling where their food plants invite them—mainly in fields of wheat in neighborhoods where this crop is grown; and there they will suck the sap from the crop plants and grasslike weeds in the field, and will presently begin to lay their eggs.

This movement of dispersal will continue well into May, and it may carry the bugs into many counties additional to those now infested. Some of the latest to emerge and fly abroad will lay their eggs in oats, and others possibly in young corn; but where wheat is generally grown, the greater part of this hibernating generation will first infest that crop.

There is no way in which crops exposed can be protected against this spring invasion, or in which the old bugs infesting the small grains, or the young bugs hatching from the egg, can be destroyed before harvest time. The first opportunity for a successful attack on the chinch-bug will come when the grain is cut, the old bugs being then practically all dead, and the young not having yet got their wings. As their food supplies disappear in the infested fields with the ripening and harvesting of the grain, the bugs are compelled to move out on foot in search of new food plants, the best of which available to them at this time is corn. It is the task of the farmer to prevent their escape from these harvested fields, and especially to protect his corn from invasion at harvest time by the new generation which has taken its start in wheat.

If this is not done, the wheat-field bugs will first lay waste the corn nearest the wheat to a distance across the field varying with their number and the weather of the season, and then, as they get their wings, they will fly everywhere, infesting corn fields generally and producing there a much more numerous second generation, to the widespread

injury of the crop. It is true that very wet weather coming at this hatching time may arrest this process and so reduce their number that no serious injury will follow; but the farmers of the state can hardly afford to bet their corn crops that things will take so fortunate a turn this year; especially as they can, if they will, secure a large part or all of this result by their own activities and at an expense which is trifling compared with the values at stake.

The Illinois Method

What may be called the Illinois method of attack upon the chinch-bug consists of a combination of barriers of a repellent substance laid along the borders of a field to stop the movement of the bugs, with trap-holes beside it, together with an insecticide spray applied to infested corn under certain special conditions.

This barrier method was first used in McLean county, Ill., in 1871, a row of fence-boards being set up beside the infested field with coal-tar applied to their upper edge; but later in the same season the tar was simply poured upon the ground, holes being dug beside it to trap the bugs. A hundred and fifty barrels of coal-tar were used for this purpose in that year near Bloomington. This method was greatly improved in 1911 and 1912 by the substitution of the petroleum products known as road-oils No. 6 and No. 7; and in 1912 and 1913 it was made still more practicable by the discovery that crude creosote and crude carbolic acid might be used instead of the road-oils.

The chinch-bug was first killed on corn by means of insecticide sprays in McLean county in 1882, an emulsion of kerosene and milk and kerosene and soap-suds being successfully used for this purpose. This method was also improved in 1910 by substituting for the kerosene a tobacco solution known as "Black Leaf 40," the efficiency of which was increased by the addition of soap. In 1912 it was found that if a soap solution of the proper strength were used, the tobacco might be entirely omitted; and many fields of young corn were saved that year by treatment with this spray.

The usefulness of these operations depends very largely upon a general participation in them, since the individual farmer may destroy all the chinch-bugs bred in his own fields and yet suffer heavy loss, later in the season, from chinch-bugs flying in from other farms, where the work has been neglected. An important part of this method is, consequently, the organization of communities for a general cooperative attack upon the insects at the proper time, and in the best available manner. Our first successful attempts to this end were made in 1911, and much excellent cooperative work has been done in the later years.

The Method in Detail

In a situation like the present the first important undertaking must be to arouse, inform, advise, and organize for cooperation the farming population of infested districts. The field agents of the

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Entomologist's office are keeping close watch of field conditions throughout and around the area infested last year; and by circulars, posters, newspaper notices, public meetings, and personal interviews, the communities concerned will be kept advised, as far as possible, of what they have to expect and prepare for as the season advances.

A preliminary circular was issued February 28, and the present one will be followed by a third as soon as the hibernating chinch-bugs have settled in the fields where the new generation is to appear.

Mode of Organization.—The organization of infested districts can best proceed by counties; and the agencies whose cooperation is essential in the beginning are the business men's organization at the county-seat, the county officers of the farmers' institute, and the local papers of the county. As soon as the fact is evident that widespread injury to wheat and corn is impending in any county, a conference should be promptly called of the editors, farmers' institute officers, and officers of the commercial club or other business organization, and measures should be taken for mass-meetings to be held at the larger towns, and addressed by a representative of the Entomologist's office who will discuss the local situation and the measures necessary to be taken. At this meeting township lieutenants should be appointed, to call and provide for school-house meetings, especially in districts where the danger is greatest. At these district meetings practical talks should be made, circulars distributed, questions answered, and everything made ready for the actual harvest-time operation against the chinch-bug.

At the county-seat meeting conclusions should be reached as to the means of supply of the necessary materials to farmers at the lowest possible cost. Wholesale rates, plus transportation, can usually be arranged for through an agent or committee of the business men's association. An estimate of the amount of the materials required should be sent by each man to the county agent as early as possible, in order that sufficient supplies may be certainly on hand when they are first needed.*

The success of the whole movement will depend very largely upon the spirit with which it is taken hold of by the county leaders in town and country business, and especially upon the active influence of one farmer upon another throughout each neighborhood.

The Field Operation.—As wheat-harvest draws near each owner of an infested field should make his preparations to prevent the escape of the bugs from it, especially on the side where fields of corn or oats adjoin it.

*At Greenville during the summer of 1912 the county commercial club handled the road-oil at cost, and aided generally in the campaign. At Litchfield in 1913 the retail merchants' association handled the road-oil at cost, and its officers aided the work in every possible way. At Carlinville the oil was handled at cost by a member of the commercial club, and the merchants of that city raised over $200 as a bounty fund for the payment of $2 a bushel for chinch-bugs delivered to their agent before the 10th day of July. Twenty-seven bushels of chinch-bugs were actually brought in, and several times as many might have been delivered if those destroying them had taken the trouble. Seven and a quarter bushels were caught, in fact, around one field in a week, and as the road-oil lines and post-hole traps had been in effective operation for the two weeks preceding, twenty bushels is a fair estimate of the quantity of chinch-bugs caught about this one field. When we take account of the fact that a single bushel at harvest time contains over eight million bugs, and that each female of this generation would commonly lay from 100 to 300 eggs, we may form some idea of the effect of such destruction upon the numbers of the second generation.

The materials to be poured upon the ground for making the barrier lines are No. 7 road-oil as made by the Standard Oil Company at its refinery in Whiting, Ind., or crude creosote (containing 8 to 10 per cent. of tar acids), or crude carbolic acid, to be obtained from almost any large wholesale dealer in paints or drugs. The No. 7 road-oil of the Whiting refinery is a nearly perfect material for this purpose, and it has been longer and more thoroughly tried out than the other substances. It has, however, the disadvantage that it is not on the general market, and must be made in advance for this particular use. Advance arrangements must consequently be made for the amount likely to be needed for the season; and it is difficult to dispose of any surplus remaining. The creosote and carbolic acid, on the other hand, are common market products, much used for other purposes, and can be had in any quantity by giving previous notice to insure a sufficient supply within reach at the time.

The cost of the road-oil necessary to maintain a mile of the barrier for an average season will be $9 this year, and that of the creosote will be $13. If we take into account the labor of the farmer and his team in the preparation of the ground for the road-oil or the creosote, respectively, we must add $23 per mile for the road-oil and $15 for the creosote or carbolic acid. The total cost, on this basis, will be $32 a mile for the road-oil treatment, and $28 a mile for that with creosote.

The most difficult part of the field operation is the preparation of a path along the border of the infested field upon which to pour the materials for the barrier line. For the creosote it is only necessary that a bare and fairly level surface, reasonably firm, should be made ready; but for the road-oil a hard smooth surface is much more essential. The latter must be kept so sticky that the bugs can not cross it, and consequently must not be permitted to sink into the ground. The creosote acts by its offensive odor, such that the bugs will not cross it even though they might do so if they would, and these odors are given off from the saturated soil after the fluid has soaked into the ground.

No single method of preparing the line will answer in all places and under all conditions, and much must be left to the experience and judgment of the farmer himself. The following discussion of this part of the subject is taken from a manuscript report of Mr. W. P. Flint, my field assistant for central Illinois, who will be in general charge of the state campaign against the chinch-bug this year.

"The chinch-bug barriers," he says, "are prepared by making a smooth path around the wheat field just before harvest, and pouring upon this a narrow line of some substance which the bugs can not or will not cross. On the side of this line next the wheat, post-holes are dug about 20 feet apart and from eighteen inches to two feet in depth.

"Under ordinary weather conditions, such a barrier may be very easily made; but with weather as dry as that of 1913, it was difficult to make a smooth path around the field. If this can be made beside a lane or public road, where the ground is compact and firm, and where there is very little vegetation to be removed, it is a comparatively simple matter; but where the path is made in the edge of a wheat

Fig. 1. Road-oil line around a field of wheat nearly destroyed by chinch-bugs. Note the perfect condition of the corn field beside the wheat.

field or in the cultivated soil of a field of corn, it is more difficult to make a path smooth and firm enough to hold the road-oil for any length of time at high midsummer temperatures. If road-oil is to be used, the path should have a slight depression in the center, to keep the oil from spreading.

"Some of the best paths in stubble ground have been made during the past two years with a drag of heavy plank about six feet long, cut to a V-shape at the front end, with strips of iron, sharpened to a cutting edge below, attached on both sides of the "V", and with a small share in the center. A strip of iron an inch square, attached to the center of the under side of the plank, makes a slight groove in the path.

"On cultivated ground, the best paths have been made by drawing a heavy drag back and forth until the ground is smooth and firm, a groove being afterwards made by running an empty wagon over the ground so that one wheel comes in the center of the path. Good paths have also been made by dragging the drive-wheel of a binder or mower over the ground; or, if a road-grader is available, this may be used to advantage.

"Some have plowed a shallow furrow, cleaning it out with a spade or hoe; and others have thrown up two back-furrows, smoothing the ridge by rolling, and making a line along its center. For a road-oil line, such a ridge should be made at least a fortnight in advance, to allow the ground to settle. This is a good practice with any kind of a path, as the chinch-bugs sometimes leave the field before the wheat is cut, and delay until they begin to move may cause the loss of corn for a number of rows next the infested wheat.

"If creosote is to be used, the surface on which it is to be poured need not be so carefully prepared, a fairly smooth path from six to eight inches wide being all that is necessary. In fact, several used this substance successfully last year, where no path at all had been made, by pouring it on the bare ground of the cultivated corn-field or on the grass of a pasture; and this may be done in an emergency where the bugs leave the wheat unexpectedly before harvest. The amount of creosote necessary and the labor required for the maintenance of a line, may be considerably reduced by using as a carrier coarse salt, or stable manure as free as possible from straw. For this purpose the manure should be spread along the center of the prepared path in a way to make a ridge about four inches wide and two inches high. The creosote or carbolic acid poured upon this ridge is absorbed by it, and held for a much longer time than if spread upon the bare ground. If salt is used, a similar but narrower line may be laid by hand, a barrel of salt being sufficient for about a mile of the line. This last material has no advantage over the manure, where both may be had, and it has the defect that it may be dissolved by a heavy rain.

"The post-hole traps should be so placed that the tar line, when laid, will touch each one, and the mouth of the hole should flare a little, giving a slightly sloping surface. This should be kept well dusted, so that the bugs can not maintain a foothold and will fall back into the

Fig. 2. An unprotected corn field, 1912. The chinch-bugs entered it from the field of wheat, a little of which is shown in the foreground.

hole if they attempt to climb out. This is especially likely to happen if a shower of rain occurs. As a preparation for this, several farmers last year laid in a supply of sacks of fine dust when the weather was dry, using this to keep the trap-holes in the best condition.

"For killing the bugs as they collect in the holes the simplest method is to pour a little kerosene into each from time to time; and if the bugs accumulate in large numbers, water may be poured in first, and the kerosent on that.

"It remains to describe the method of laying the line on the prepared path. If road-oil is used, a stream half an inch thick or less may be poured from a pot with a tubular spout; or, more conveniently perhaps, a hole may be made in the bottom of a large tin pail and near one side, into which a whittled stick or similar plug may be fitted, long enough to reach above the top of the pail. When this is filled with road-oil, the plug is withdrawn and the oil streams out of the hole as one walks slowly along, carrying the pail steadily to make an even line. A stream which will spread on the ground to the width of one's finger is quite sufficient for the first treatment, and the hole in the bottom of the pail should be made large enough to make a line of this width when the road-oil is somewhat thick with the cold. The size of the stream when the oil is more fluid, as the day warms up, may, of course, be readily regulated by means of the plug.

"Creosote or carbolic acid may be best applied in a similar way. A hole the size of a 6-penny or 4-penny nail should be made in the side of a tin pail near the bottom, and from this the fluid will spout out freely enough to enable one to lay the line about as fast as he would naturally walk."

Whatever materials are used, the line must be freshened from time to time by pouring more oil or creosote upon it. The road-oil line must be renewed as soon as the surface becomes dry—once in two or three days, more or less, here or there, according to the soil and the temperature. The hotter the weather the more fluid the oil becomes and the sooner it soaks into the ground. Under fairly favorable conditions, No. 7 oil may continue to turn the bugs, after the line is well established, for a week or ten days without renewal. The creosote and carbolic acid, on the other hand, are effective only so long as the odor is sufficiently strong to repel the bugs, and it is commonly necessary to renew these substances every day. The person in charge should at least walk along the lines once a day when the bugs are in active movement, and strengthen the barrier as he finds it necessary.

Various modifications of the above modes of operation, and many experiments with other more or less available materials, have been made by us in the course of the last few years, the particulars of which will not be given here, as they may be obtained from the field agents, by those interested, when the time comes for active work.

The Dusty Furrow.—"The oldest barrier is probably the dusty furrow or dusty strip, made between the wheat and the corn by plowing a shallow dead-furrow, or, better, two or three such furrows, side by side, and dragging a log back and forth repeatedly in them. Some

Fig. 3. A protected corn field, 1912. Road-oil and post-hole traps between the corn and the wheat, by which millions of the bugs were caught.

of the best barriers have been made during the past two years by plowing two or three furrows about a foot and a half apart, then fastening together two or three logs, eight or ten inches in diameter and four to six feet long, side by side, with strips of board nailed across the tops, making the distance between the logs the same as that between the furrows. By means of this drag one can keep up two or three furrows with the same labor that would be needed for one. To raise the cross-boards so that they will not drag on the ridges between the furrows, it will generally be found necessary to nail strips of board or plank on the top of the logs, to which the cross-strips may be fastened. On some soils, during dry weather, very effective work has been done by this method, but on other soils it is useless, as a layer of sufficiently fine dust can not be made. Furthermore, the slightest shower at any time will make the surface firm enough to permit the bugs to cross; and this method can never be depended on for controlling a chinch-bug movement. This kind of a barrier is much less expensive than the others, but in our climate it is mainly useful in emergencies and when weather conditions are temporarily favorable."

Many chinch-bugs caught in the dusty furrow, particularly the young, are killed by exposure to the heat and dust, and by the dragging process necessary to keep the furrows in good condition. Many of the older bugs are likely to be crowded out of the furrow, however, by this means, and so allowed to escape. Indeed, they will gradually pull down the dust on the side of the furrow by their incessant efforts to climb up, and will thus make a way out. It is desirable, consequently, that they should be killed in the bottom of the furrow at least once a day. This can best be done by the use of a gasoline blast torch of a kind now made by the Turner Brass Works, at Sycamore, Ill., and called by them the "locust torch." A much better but more costly machine for this purpose is the so-called "cactus burner" of the southwest. Our own experiments with gasoline torches against the chinch-bug were made in 1902, and they have not been lately repeated on a large enough scale to permit me to recommend this apparatus on my own experience. Professor Headlee has lately gone much farther with the locust torch in Kansas, and says that it has "proven itself admirably adapted to our needs, for not only are we able to destroy the bugs by simply passing the flame along the furrow where they have collected, but without inconvenience the furrow can be repaired as often as is necessary by dragging a log or trough through it." This torch, he says, "is the most efficient because it furnishes a strong blue flame six or eight inches long and two and a half to three inches through, which fills the dusty furrow where the bugs are struggling with a strong blast of blue flame and is not blown out by the wind. The purchaser should insist on getting a torch having these specifications."

Insecticide Sprays.—There are two conditions under which it has proved highly profitable to spray corn infested by chinch-bugs. One of these cases is where young corn is attacked in spring by the old bugs as they come out from their winter quarters and by the young as

these hatch from the egg. The other is where, through neglect or accident, bugs are permitted to escape from a wheat field to a corn field adjacent, and accumulate there in great numbers on the outer rows previous to scattering over the field. A very effective insecticide is made by putting a strong tobacco extract known as "Black Leaf 40" and any good laundry soap into water at the rate of ¼ ounce of the tobacco extract and 1 ounce of the soap to a gallon of water. A mere solution of 3 ounces of certain kinds of laundry soap to the gallon of water is, in fact, nearly as effective with the tobacco omitted. These fluids must be applied to the corn thoroughly enough to wet every bug, but carefully enough to prevent filling the "curl" or cone-shaped cavity among the leaves at the top of the plant.

It has been found that certain kinds of soap are much more effective than others, the best, in our experience, being the common brands known as "Rub-no-more," "Mottled German," "American Family," and "Peosta," to be preferred about in the order named. For the best results, soft water should be used, but this is not essential.

The best sprayer for chinch-bug work, within our knowledge, is a small compressed-air sprayer carried by a strap over the shoulder, and holding about three gallons and a half of liquid. It is charged with air by a few strokes of the plunger, and the spray is forced out by the pressure. Such sprayers, costing from $4 to $6, according to the material of which they are made, can be bought from any large hardware or mail-order house. The nozzle which has given the best result is an adjustable one of the "Kant-Klog" type, so adjusted as to give a straight stream instead of a broken spray.

Additional copies of this circular may be had in any number by application to the undersigned. Those receiving it are earnestly requested to aid in its distribution in their respective neighborhoods, and also to communicate their observations and the results of their experience either to this office or to W. P. Flint, 1231 W. Edwards St., Springfield, Ill.

Stephen A. Forbes,
State Entomologist.

Urbana, Ill.,
April 16, 1914.

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